

# STEREO and the Virtual Heliospheric Observatory

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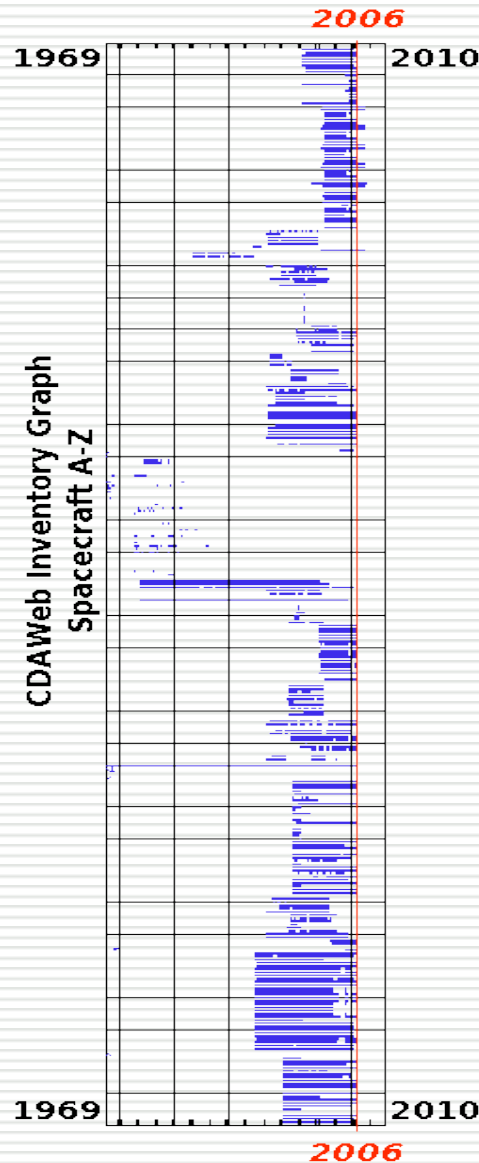
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<http://vho.nasa.gov>

**STEREO/Solar B Workshop - November, 2005**

# Scientific Quest is Changing



- Past – In-depth single spacecraft studies
- Future – Study multi-spacecraft / multi-instrument local and remote sensing measurements
- STEREO
  - Multi spacecraft platform with remote and in-situ instruments
  - Addresses large-scale heliospheric structures so it would uniquely benefit from other platforms

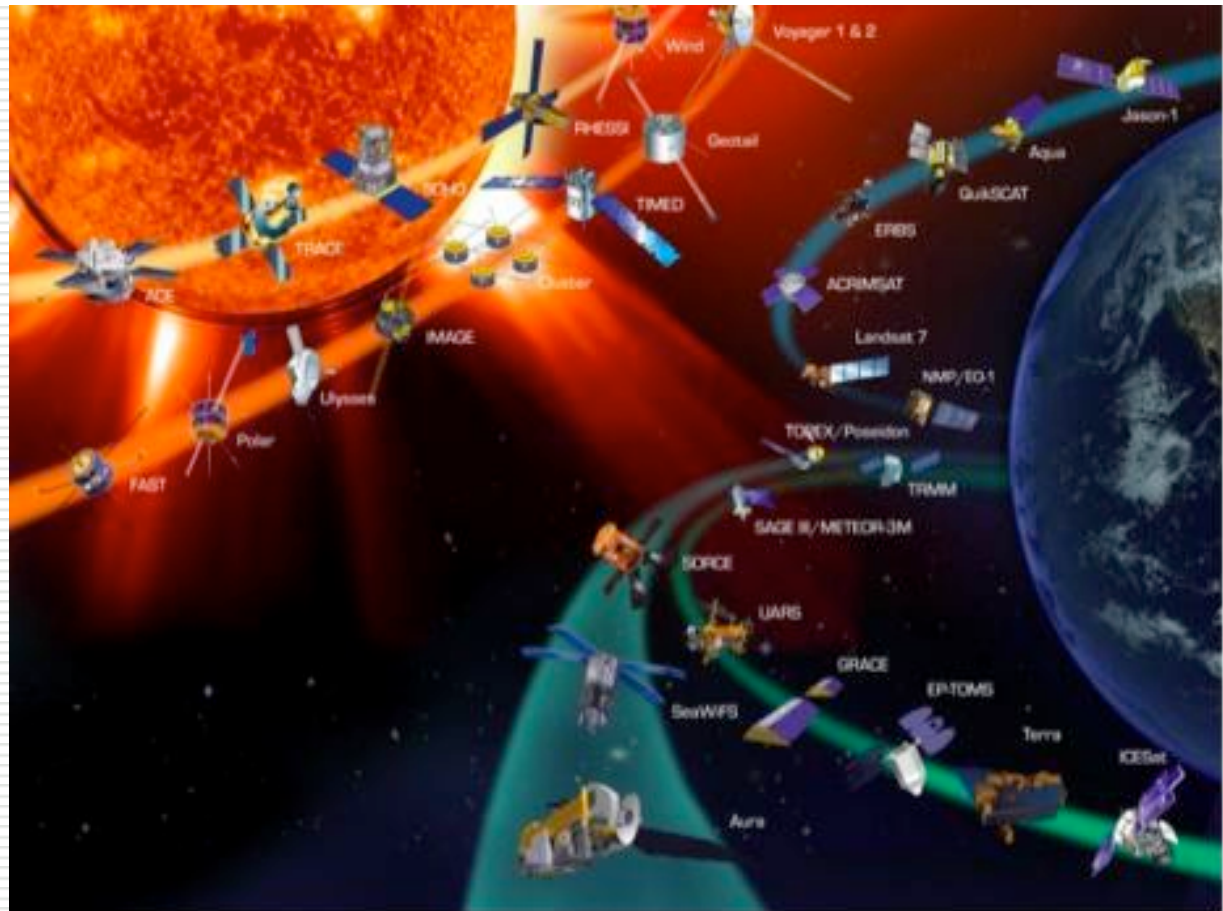
# Battle of WITS

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- **W**: Where to find data?
  - **I**: Integration of data from various sources is often difficult.
  - **T**: Tools are needed to work with the data.
  - **S**: Scientific perspective introduces additional questions:
    - Integration of distant heliospheric observations
    - Time-space propagation (what is a match?)
    - Integration of remote and in-situ measurements
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# Why Virtual Observatories ?

- ❑ Many datasets with large volumes
- ❑ Data sites distributed worldwide
- ❑ Stored in a variety of formats
- ❑ Accessible through a wide variety of interfaces

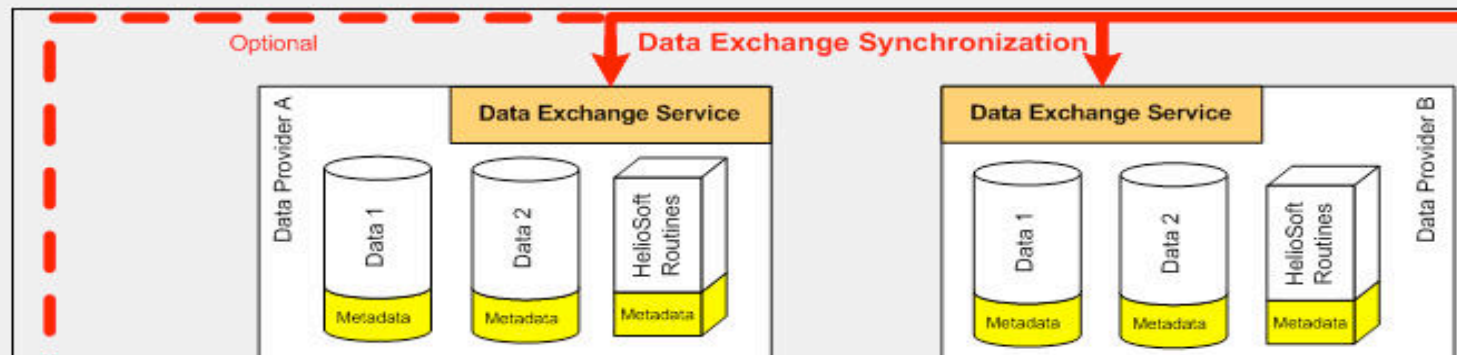


# What is the goal of the VHO?

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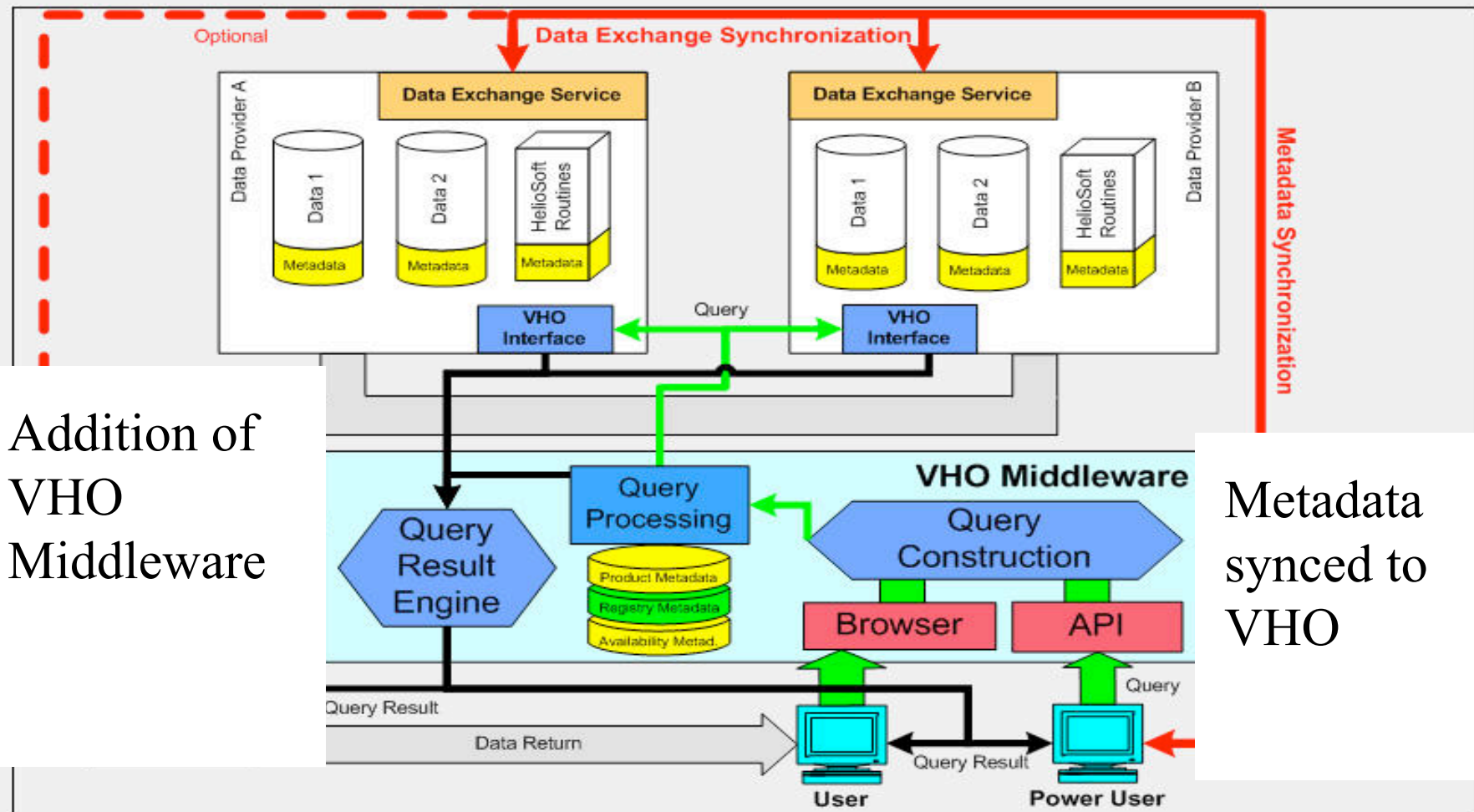
- ❑ Science based discovery of heliospheric data
  - ❑ Unified, yet simple, environment to access all heliospheric data sets and tools
  - ❑ Provide rapid community access to the highest quality processed data
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# VHO Design



- Existing data providers plus new Metadata descriptions of data and data products
- SPASE dictionary
- Data Synchronization

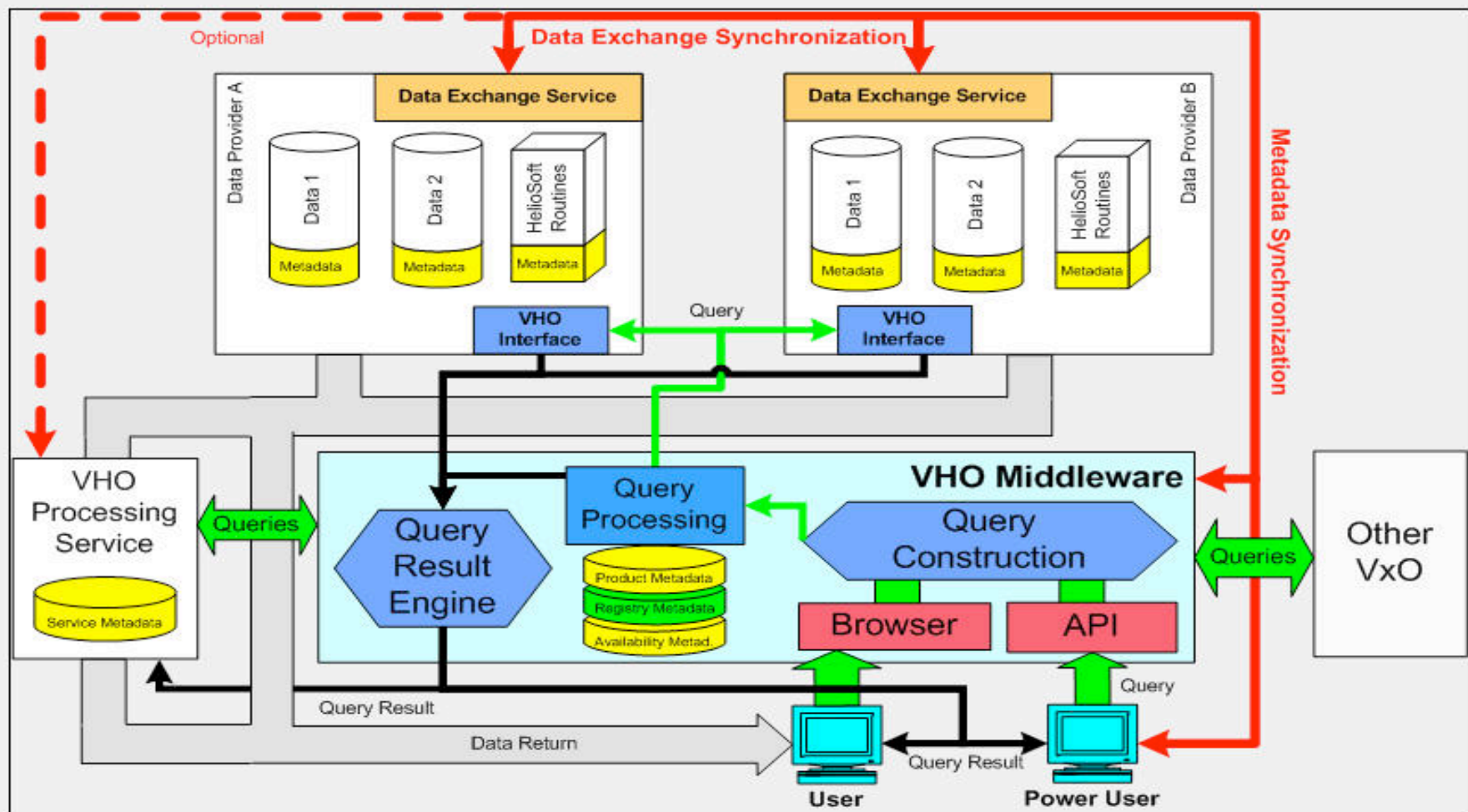
# VHO Design



Addition of  
VHO  
Middleware

Metadata  
synced to  
VHO

# VHO Design



# Initial VHO Data Participants

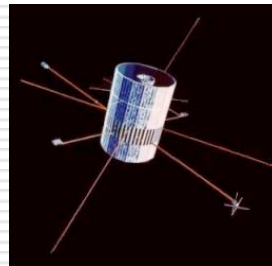
## 8 Spacecraft - 13 Data Sets

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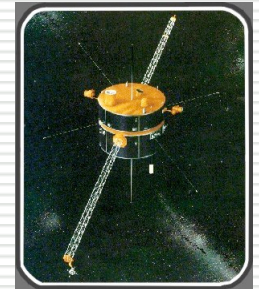
### ACE

- Magnetometer
- SWEPAM



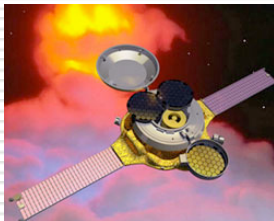
### IMP 8

- Magnetometer



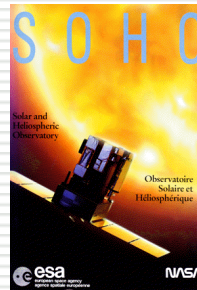
### WIND

- MFI
- SWE
- ELPD
- PLSP



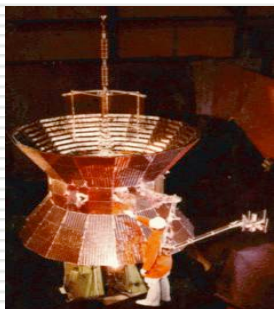
### Genesis

- Mag. Field Proxy
- 3D Moments



### SOHO

- Cielas instrument



### Helios 1 and 2

- Magnetometer
- Plasma instrument



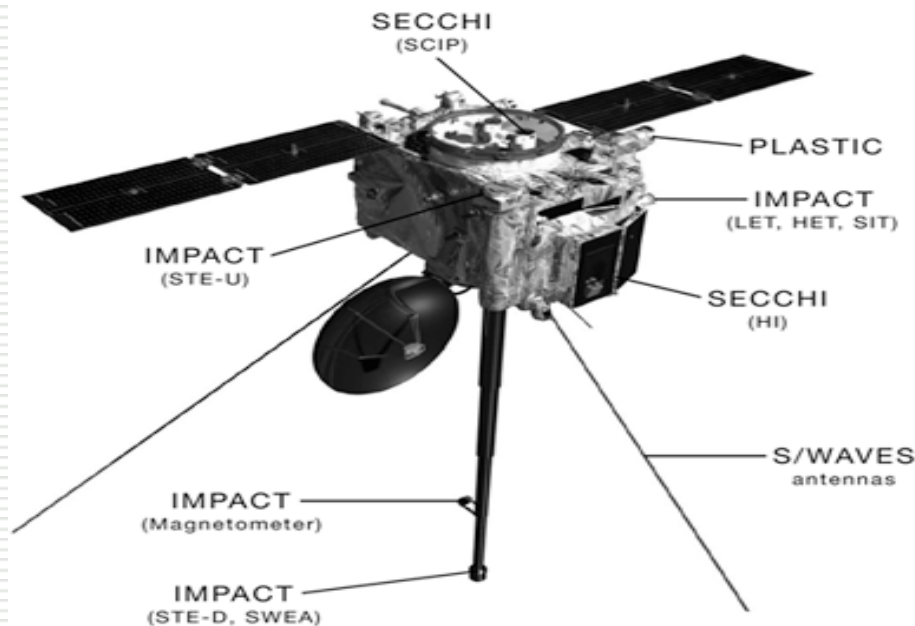
### Mars Global Surveyor

- Solar Wind Pressure Proxy
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# Addition of Instruments and Spacecraft

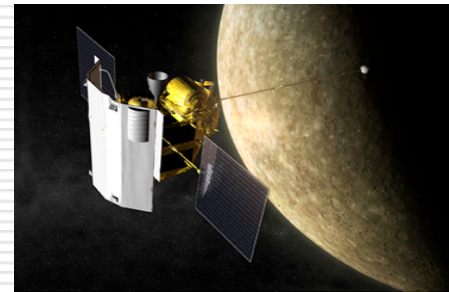
## Total: 12 Spacecraft - 30 Data Sets

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### **STEREO**

- IMPACT - PLASTIC



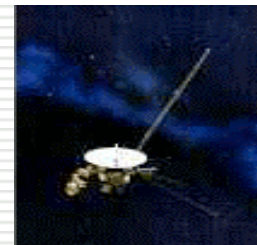
### **Messenger**

- MAG  
- EPPS



### **Ulysses**

- VHM (mag field)  
- BAI (ions)  
- BAE (electrons)

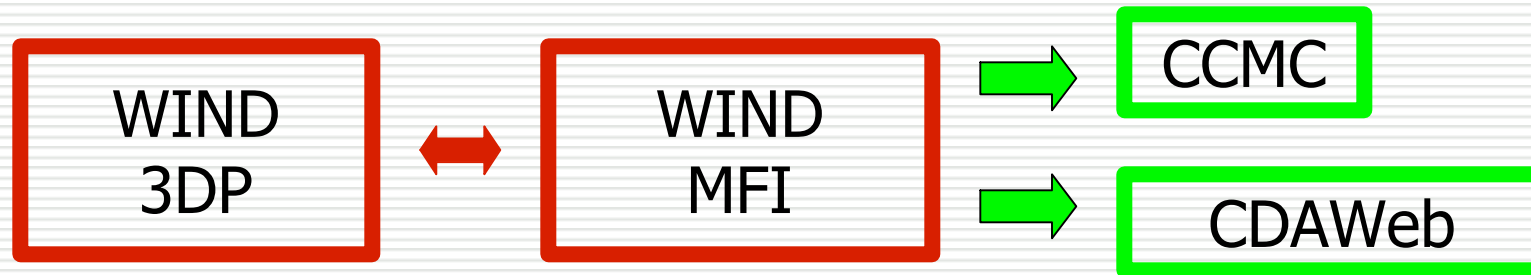


### **Voyager**

- MAG

# Data Synchronization

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- WIND 3DP processing requires most recent and highest quality MFI data

- Automated synchronization makes archiving requirements easier



**VHO Member**



**Data  
Recipient**

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# Current Types of VHO searches

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- Science driven data searches:

<u>Time</u>	<u>Space</u>	<u>Measurement</u>
1. Date/Time	1. GSE	1. Magnetometers
2. Bartel Rotation	2. GSM	2. SW Plasma
	3. HGI	3. Particles/Moments
	4. Spatial Region	

Other: 1. Event Lists

- Spatial Region search allows for keyword search

examples :

Bow Shock to ~60 Re, L1, Inner Heliosphere ( < 0.8 AU )

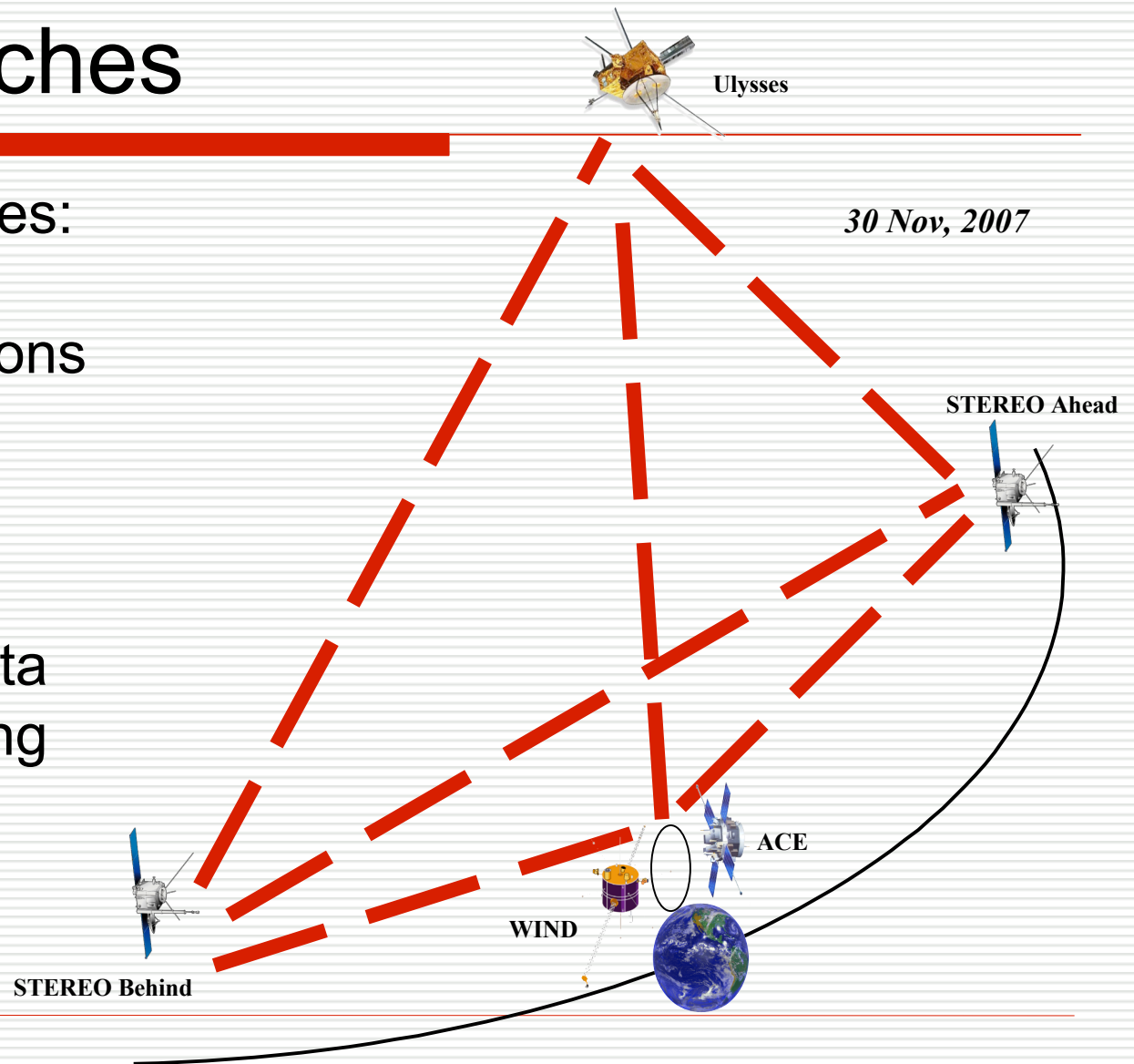
Mid Heliosphere ( 0.8 AU to 5 AU ), Outer Heliosphere ( > 5 AU )

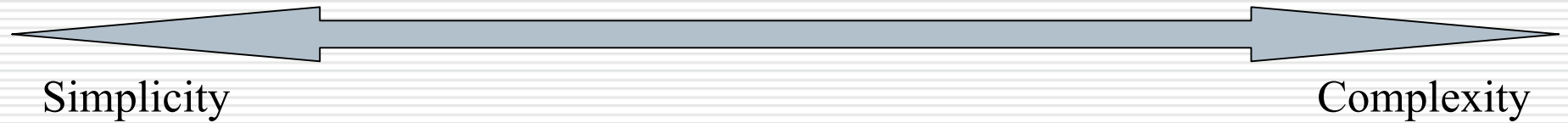
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**Note: solar wind data only, magnetospheric data removed**

# VHO Searches

- Complex Queries:  
find data when  
multiple conditions  
are true
- Find other  
heliospheric data  
sets to use along  
with STEREO





# Spectrum of Users

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## Web Based Interface

## Public Tools

CoSEC, ACE Science Center

## Application Programming Interface (API)

- 
- Access all types of searches and services from VHO web page

- CoSEC Client software being written to access VHO

- Access VHO from your own software

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- Easy access
  - Fixed Interface

- More advanced and community provided
- Dependant on tool providers

- Complete flexibility
  - Steep learning curve
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# Services and Tools

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- **Services offer automated data processing:**
    1. Coordinate Transformations - 12 coordinate systems
    2. Ascii Subsetting - subset a few hours from file
  - CoSEC interface offers ability to use services outside of VHO
  - Examples of how to use through API/CoSEC
  - Example of how to interface with SSCWeb
  - Metadata standardization for services
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# STEREO Related Functionality

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- Collaborating with VSO team to set up cross VO queries
    - STEREO data users will not have to go to both VSO and VHO to get STEREO data
  - Future Services
    - Merging multi-spacecraft time series data and solar images into one file
    - Backtracing to get solar images
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# Summary

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- Prototype available at <http://vho.nasa.gov>
  - Encourage community input on services and methods used in services
    - SW propagation methods
    - Means of combining in-situ and remote data
  - Encourage input regarding models and their integration into virtual observatories
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